HUMAN FACTORS INFORMATION REQUIREMENTS FOR SPACE SYSTEM DEVELOPMENT

Quarterly Status Report
for Contract Number NASr-194
(1 April 1964 - 30 June 1964)

American Institutes for Research
Pittsburgh, Pennsylvania

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Prepared for:

National Aeronautics and Space Administration
Washington, D. C.

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The final quarter of this project was devoted entirely to analysis and preparation of the final report. The comments from interviews with about 50 life scientists, human factors engineers, and other system development personnel were organized into 74 individual requirements for improved human factors information to support the development of space systems. Each of the 74 individual requirements was evaluated in terms of the development decisions supported and relationship of the requirement to other requirements. Six general requirements were identified. They are as follows:

1. Basic Data Concerning Selected Aspects of Human Functioning.
2. Improved Availability of Technical Reports.
3. A Human Factors Data Storage and Retrieval System.
4. Definition of the Trade-off Between Application of Existing Research Results and Initiation of New Research.
5. Improved Communication Between Human Factors and Other Program Personnel.
6. Definition of the Appropriate Role of the Skilled Worker in Establishing Requirements.

The other 68 requirements fell into one of eight areas. The areas with the specific requirements related to each are shown below.

7. Integrated Procedures for Human Factors Program Planning and Control.

7.1 Improved liaison between human factors research laboratories and system programs.

7.2 An improved system for carrying over data from one program to another.

7.3 Improved definitions of human factors personnel, organization, and responsibilities.

7.4 Improved human factors objectives and milestones.

7.5 Improved definition of human factors input and output needs on a program time scale.

8. Integrated Man-Machine Function Allocation Procedures.

8.1 Policy concerning man-machine tradeoffs.

8.2 Tradeoff models for function allocation.

8.3 Improved techniques for making performance, reliability, and cost comparisons between personnel and equipment.

8.4 Quantitative data about human performance.

8.5 Establishment of criteria for design affecting the human.

8.6 A technique for integrating human performance data from different sources.

8.7 A consistent basis for measuring, describing, and estimating the impact of environmental factors on performance.

9. Integrated System, Function, and Task Analysis Procedures

9.1 Improved definition of purposes for system, function, and task analysis results and procedures for applying these results.

9.2 A basis for relating new task requirements to the body of available human performance information.

9.3 A technique for identifying common tasks and abrogating the need for redundant analysis.

9.4 Procedures for correlating task requirements with environmental factors and personal equipment as well as with prime equipment.

9.5 Procedures for contingency prediction and analysis.

9.6 Compatible procedures for analyzing the requirements and interactions of all activities, not just operational tasks.

9.7 Procedures for estimating the criticality of tasks.

10. Integrated Human Engineering Procedures.

10.1 Human engineering design criteria uniquely appropriate to NASA systems.

10.2 Definition of the appropriate roles of "common sense," analysis, research, and simulation in human engineering.

10.3 Definition of tradeoffs between human engineering characteristics and cost-time considerations.

10.4 Data relating human engineering considerations to environmental characteristics.

10.5 Techniques for simultaneous human engineering of prime equipment, personal equipment, support equipment, informational job aids, and procedures.

10.6 Improved integration of anthropometric data and human engineering techniques.

10.7 Data concerning relationships among anthropometric, task, environment, personal equipment, expendable item, and social variables.

10.8 Basic task data for unique space conditions.

10.9 Improved techniques for including mission considerations in human engineering.

10.10 Improved techniques for using task data in human engineering.

10.11 Relationship between dynamic characteristics of an individual and task performance.

10.12 A more adequate basis for determining display needs.

10.13 Human performance data in a form which is directly meaningful to the system engineer.

10.14 Information concerning feasible techniques for display and control under unusual environments.

11. Integrated Job Design and Personnel Forecasting Procedures.

11.1 Improved procedures for job design.

11.2 Improved procedures for personnel forecasting.

11.3 Improved availability of information concerning job design and personnel forecasting experience on previous systems.

11.4 Information concerning the availability of personnel.

12. Procedures for Integrating Personnel Selection, Training, and Proficiency Assessment.

12.1 Delineation of populations from which it will be appropriate to draw trainees.

12.2 Identification of appropriate selection variables, methods, and techniques for validating selection.

12.3 Determination of selection requirements for long-term adjustment and stress tolerance.

12.4 Improved techniques for determining training requirements.

12.5 A rigorous basis for relating training requirements to training methods, aids, equipment, facilities, and schedules.

12.6 Learning and retention curves for various performance parameters on different classes of tasks; as a function of training techniques and aids.

12.7 Determination and codification of space environment characteristics having unique training requirements.

12.8 State-of-the-art information about training techniques, aids, equipment, and facilities.

12.9 A technique for determining proficiency measurement requirements early in development.

13. Procedures for Integrating Human Factors Efforts and Data in Development of Job Performance Aids.

13.1 Definition of the role for human factors data in informational job performance aids.

13.2 Human factors criteria for informational job performance aids.

13.3 Determination of more effective methods for presenting job information.

13.4 Delineation of a role for human factors personnel in the preparation of informational job performance aids.

13.5 Guidance on the use of subject testing in preparation of informational job performance aids.

13.6 Information about current practices in the development and use of informational performance aids.

14. Procedures for Integrating Human Factors Evaluation and Testing.

14.1 Definition of the appropriate role of evaluation versus testing.

14.2 Development of a human factors evaluation and testing model which is dovetailed with system development phases.

14.3 Procedures for establishing appropriate objectives, standards, criteria, and measures for human factors evaluation and test.

14.4 Guidance concerning appropriate evaluation and testing costs.

14.5 Further development of operability and maintainability indexes.

14.6 Guidance concerning the selection of human factors aspects for testing and evaluation.

14.7 Guidance on the qualification testing of hardware developed by human factors groups.

14.8 Definition of the role of operational equipment, prototype equipment, system simulators, and mockups in human factors testing.

An appendix of sample interview comments was also prepared.

The preparation of the final report has been completed and a draft manuscript is being submitted to NASA for review.